AN ANALYSIS OF PEDESTRIAN-VEHICLE COLLISIONS IN RURAL NEW BRUNSWICK

by

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Abstract

Addressing rural transportation challenges in New Brunswick, especially for vulnerable road users, is a topic that has not been adequately studied. This research paper undertook a thorough review and analysis of collision data collected by the provincial government from 2001-2012. The results of the research found that 510 pedestrian-vehicle collisions occurred in rural New Brunswick during the studied period. Property damage only, injury, and death accounted for 106, 339 and 64 collisions, respectively. Closer analysis was carried out on the 64 collisions resulting in one or more fatalities. The study showed that 67.2% of collisions occurred after dark and that pedestrian error was the most prevalent major contributing factor (43.8%). Other contributing factors of note include driver inattention (14.1%) and glare (6.3%). The report has shown the need for increased research to better understand the needs of all vulnerable road users and more focus among highway engineers to ensure safe transportation for all.

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Chapter 1: Introduction

1.1 Background

The Province of New Brunswick's population is unique given that it is evenly dispersed between urban and rural areas. According to Statistics Canada (2011), nearly half the population lives in a rural area of the province. In comparison, only 19% of the entire Canadian population lives in a rural area (Statistics Canada, 2011). Despite the even distribution of urban/rural populations, very little research has been carried out, by the province or researchers, that addresses rural transportation challenges in New Brunswick, particularly pedestrian safety.

1.2 Problem Definition

Pedestrian safety in rural New Brunswick is a topic that has not been adequately studied. Studies have found that with higher speeds of the vehicle involved in pedestrian-vehicle collisions, the greater likelihood of more severe injuries to the pedestrian (Rotherman, *et al.*, 2015); there is reason to be concerned for those who walk in higher speed rural areas as they are particularly at risk. In New Brunswick, most rural highways have speeds greater than 50 km/hr and provide no sidewalk or paved shoulder, which combine for a higher risk environment for pedestrians. Although the provincial government has collected detailed collision data for years, a study has yet to be carried out that explores the extent of pedestrian-vehicle collisions. It remains unknown whether pedestrian-vehicle collisions present a significant problem in rural New Brunswick. This report will focus on providing a better understanding of the issue of pedestrian safety in rural New

Brunswick.

1.3 Goals and Objectives

The overarching goal of this report is to examine the number of pedestrian-vehicle collisions on rural New Brunswick highways and to determine underlying, primary factors that influence these collisions. Particular interest will be given to characterizing the collisions that resulted in pedestrian fatalities. In accomplishing this goal, the following objectives were undertaken in order to complete the research:

- Provide an overview of pedestrian-vehicle collisions in rural New Brunswick
- Conduct a thorough review of all rural pedestrian fatalities and compare them to urban pedestrian-vehicle collisions
- Investigate school zone related pedestrian-vehicle collisions
- Provide a dataset specifically for pedestrian collisions that will be compiled and sorted from the New Brunswick Department of Transportation and Infrastructure's Accident Report database for future research.

1.4 Scope

The research in this report used collision data collected and provided by the New Brunswick Department of Transportation and Infrastructure from 2001-2012. Resulting from a lack of research and focus on pedestrian safety, it had become necessary to develop a more complete and comprehensive understanding of pedestrian-vehicle collisions in rural New Brunswick. The results of the research attempt to highlight any areas of concern that may be further explored in future research to help improve safety for vulnerable road users.

1.5 Research Methodology

All data used in this study were collected from 'Report of Motor Vehicle Accident' forms (depicted in Appendix A), used by all police agencies in the province of New Brunswick over an eleven-year period from 2001 to 2012. These reports were submitted to the Department of Transportation and Infrastructure's Maintenance and Traffic Branch where they were coded and entered into a provincial collision database.

Using the query function in the collision database software, a search was performed to flag all reports that had the code 12 in the "Position In/On Vehicle" field. Number 12 was the identifier for when a pedestrian is involved in a collision. All collisions and associated data that were flagged as a result of the query were entered into Microsoft Excel spreadsheet to easily sort and filter the information.

The data were then sorted to eliminate any collisions occurring in an urban setting. For this study, it was decided that collisions specified as occurring in either a city or a town would be eliminated. The list of municipalities, as defined by the province, can be seen in Appendix B "List of Municipalities in New Brunswick". To eliminate the urban area collisions, the data were sorted by "Municipality" codes. The remaining data were then manipulated and filtered in various ways to all for the analysis and results presented in this research report.

1.6 Report Structure

The remainder of this report is structured as follows:

Chapter 2 contains a review of relevant literature and background information pertaining to this research. This includes a review of pedestrian-vehicle collisions or characteristics across Canada, a summary of safety devices used by various jurisdictions, and a review of the current issues faced by pedestrians in rural areas.

Chapter 3 presents a frequency analysis and summary of the results of the analyses of the collision data related to those cases involving pedestrians in rural areas.

Chapter 4 provides a discussion of results including any limitations and strengths of the Research, provides recommendations for future related work and synthesizes the research conclusions.

Chapter 2: Literature Review

In a time when people are encouraged to be physically active to promote good health or for those of low socio-economic status where walking or cycling is their only mode of transportation (Bostock, 2000) it is becoming increasingly difficult for this group of users to find safe, adequate space to walk or cycle. Many believe this may be due to the view that "transport and land-use planning have frequently neglected the needs of these road users, giving priority to road expansion and increasing accessibility associated with private car use" (Toroyan, 2013). This disregard for pedestrians and cyclists has lead to motorists assuming that roads and streets are primarily for motorized vehicles and the introduction of laws to limit pedestrian access to certain roads and streets. Some experts even go as far as arguing that pedestrian and cyclist travel should be discouraged due to the dangers users face and "the higher fatality rates per mile than motorized travel" (Litman, 2004). The disregard for pedestrians and cyclists as equal road users has led to high numbers of pedestrian-vehicle collisions, many of which result in severe injury or death to the pedestrian.

In 2013, of the 165,306 total injuries recorded as a result of traffic collisions, Transport Canada reported that 1,923 of those were deaths. The numbers of pedestrian killed as result of a traffic collision were 300, or 15.6% of all deaths (Transport Canada, 2013). In comparison, in 2012, New Brunswick reported a total of 77 fatalities as a result of vehicle accidents; 8 deaths or 10.4% of fatalities in 2012 were pedestrians. These fatal collisions are all too common in pedestrian-vehicle collision "because pedestrians have virtually

nothing acting as a barrier between themselves and a colliding vehicle" (Rotherman *et al*., 2010).

It is the opinion of some researchers that pedestrians and pedestrian safety has been for the most part ignored in the design of roadway systems (Retting, *et al*., 2003). The emphasis placed on creating safer roadways for vehicles often neglects the need for a safer network for pedestrians as well. In the United States for example, the manual entitled *A Policy on the Geometric Design of Highways and Streets* states that "every effort should be made to use as high of a design speed as practical in the interests of safety" (ASSHTO, 2004). Placing such emphasis on speed for the design of a facility means creating a facility that may be ideal for vehicles but hazardous for pedestrians and cyclists (Dumbaugh & Li, 2011). This is due to the fact that higher speeds have a strong correlation with a higher frequency of pedestrian-vehicle collisions and result in more serious pedestrian injuries (Retting, *et al*., 2003). In the study, *Relationship Between Impact Velocity and Injuries in Fatal Pedestrian-Car Collisions*, Karger, *et al*. (2000) determined that there are "threshold velocities" relating to particular pedestrian injuries. They reported that in collisions with speeds above 70km/h, spinal injuries to a pedestrian were highly likely to occur. In collisions occurring at 100km/h, pedestrians were likely to have aortic and inguinal skin ruptures. Although these injuries are horrific, they may be preventable, as there are many counter-measures available to designers to protect and improve safety for pedestrians.

One of the most discussed design elements for reducing pedestrian-vehicle collisions is to reduce or manage vehicle speeds. Reducing speeds allow drivers more time to react and control their vehicle (Retting, *et al*., 2003). One way designers can do this is to target drivers comfort and speed perception. Reducing lane widths and constructing wide gravel shoulders (Godley, *et al.,* 2004), are just a couple of example tools to make highways safer for all. There are many other techniques being used to improve safety. Unfortunately, most of them are designed for urban areas and, as such, only applied in cities. One of these techniques is called the "Complete Street" approach, which "directs transportation professionals to consistently plan, design, construct, operate, and maintain a community's transportation network to support travel by foot, assistive devices, bicycle, public transportation vehicle, car and truck" (Anderson, *et al*., 2015). With modifications, a tool like this could be applied in rural applications and achieve collision reduction result similar to those in urban areas. Approximately 70% of the "Complete Street" projects in the United States saw significant reductions in crashes, while 56% of those projects saw a reduction in the number of injuries. This design tool is also saving governments money, which means greater returns on safety. In the study carried out by Anderson, *et al.* (2015), it was estimated that the projects sampled collectively reduced collision related costs by $18.1 million in just one year. Other advances in road safety that are showing improvements for protecting pedestrians and could be used in rural applications are:

- Rectangular Rapid Flashing Beacon (RRFB) – RRFB can improve pedestrian safety, especially at non-signalized intersections or midblock crosswalks. These devices flash when activated by a pedestrian to increasing a driver's awareness. RRFB devices have been found to increase the number of motorist yielding to

pedestrians from 18% to 81%. (FHWA, 2009)

- Half Signals – Devices such as the High Intensity Activated Crosswalk Beacon (HAWK) have been found to have significant impact on reducing collisions. In a study by Fitzpatrick and Park (2010) found that intersections with HAWK signals led to a 69% reduction in pedestrian collisions and a 29% reduction in the total number of collisions.

Some jurisdictions have adopted their own unique approach to improve safety for pedestrians. In areas of Northern Europe, cities have developed a "street hierarchy", which gives highest priority to pedestrians and lowest to passenger vehicles. Other cities have implemented low-speed street designs called home zones, which allows vehicles to only travel at the speed of walkers (Zegeer & Bushell, 2012). Some agencies and jurisdictions have forgone installing countermeasures all together and instead have opted for increased police patrol. Makowsky and Stratmann (2011) found a direct correlation between an increase in road patrols and issuance of fines to the reduction in accidents. The authors conclude "that traffic fines increase the price of unsafe driving, leading to less consumption of unsafe driving and fewer accidents" (Godley, *et al*., 2004). There are also some unique solutions for pedestrian safety within New Brunswick. In Fredericton, permanent speed radar signs have been installed at the beginning of school zones where speeds reduce from 50 km/h to 30 km/h. The flashing speed sign has been successful in reducing speeds and improving safety in school zones (Hildebrand, *et al*., 2014). It is possible that this strategy could be employed in rural school areas to achieve positive benefits as well. These solutions for improving safety are reducing the number of collisions and injuries sustained by pedestrians; however, to continue to lower the

accident statistics, research and development needs to be carried out by all parties involved in the transportation industry.

Over the past few years, the motor vehicle manufacturing industry has carried out their own studies, which have lead to advances in vehicle design to improve safety for pedestrians. Pedestrian airbags, made by Volvo, have been designed to protect a pedestrian's head from making contact with the windshield and support frame. However, this system has limited capabilities as it only works at speeds from 20-50km/hour (Malloy, 2012). Also from Volvo an automatic braking system for pedestrians called "Volvo City Safety" was introduced. Using a laser system, the system automatically engages the brakes to avoid impact with pedestrians if the driver had not applied the brakes early enough (City Safety, 2016). The system is also less limited, as it works only at speeds up to 50 km/hour (Cicchino, 2016). Honda has also been introducing a number of active and passive impact reducing technologies. The 2016 Honda Civic Sedan safety features included a deformable hood and hood hinges, an impact energy absorbing windshield base, breakaway windshield wiper pivots and impact energy absorbing fender mounts and supports. Combined, these features make the 2016 Civic one of the top ranked vehicle in its class for safety (McCants, 2015). The implementation of these and other safety devices by the motor industry has made streets and neighborhoods safer for all non-motorized users.

Making roads safer is vital, especially to all those residing in small, rural communities. Nowadays, rural roads are "seen as public spaces that motivate desirable forms of

development and support quality of life" (Transport Canada, 2013). This is particularly true for New Brunswick, given that 48% of the population have chosen to live in rural parts of the province (Stats Canada, 2011). With nearly half of the population living outside major urban areas, more focus should be put on providing a greater level of safety for all rural road users. Within New Brunswick, the provincial government has tried to improve rural safety with the installation of "walking strips" or a wide paved shoulder that are intended to provide a safer place for walkers and bikers. Rather than paving both the left and right of the road, walking strips are only placed one side, which may encourage some users to walk with traffic, which is a violation under the New Brunswick Motor Vehicle Act. Section 174(2) of the Motor Vehicle act states that "where sidewalks are not provided any pedestrians travelling along or upon a highway shall, when practicable, travel only on the extreme left side of the roadway or its shoulder, not more than two abreast, facing traffic which may approach from the opposite direction and shall give way to the left to traffic approaching on the roadway." (NB Motor Vehicle Act, 1973). Unfortunately, it is unknown the effects of adding walking strips to only one side of the road are unknown since the subject matter is rarely studied.

Pedestrian-vehicle collisions in rural areas is a topic that is relatively ignored by researchers. In Canada, most pedestrian-vehicle collision research was focused on major urban areas while research for New Brunswick on the topic is almost non-existent. The undergraduate civil engineering senior report entitled "Analysis of Vehicle/Pedestrian Collisions Within New Brunswick" (Melanson, 2005) is a sole resource that attempted to provide a better understanding of the influences of vehicle-pedestrian collisions in the

province. Melanson's findings showed that the major influences of collisions were time of day, age of both the driver and pedestrian, weather conditions, and pedestrian action. Unfortunately, Melanson fails to distinguish between rural and urban collisions, which may have skewed the results of the study as there were a higher number of pedestrian-vehicle collisions occurring in urban areas.

One of the few reports to focus on rural area collisions was carried out in the United States by Hall *et al.* in 2004. The authors determined that there were a significantly high number of pedestrian-vehicle collisions resulting in fatality of pedestrians. The data showed that on average, the ten states in the study collectively experienced a collision rate of 37.72 pedestrian fatalities/year •million-people. The authors go on to mention that even though their data show a much higher pedestrian-vehicle collision frequency in urban settings, "…the potential for fatalities and serious injuries is greater on rural, high-speed highways" (Hall, *et al*., 2004). Although this is only one of a few reports in recent years on the topic, it highlights the importance of studying the local rural conditions affecting pedestrian safety.

Chapter 3: Results

A frequency analysis was used to develop an overview of the extent of vehicle-pedestrian collisions in the Province of New Brunswick, with a focus on those occurring in rural areas. Various potentially influencing factors were examined as part of the frequency analysis to determine possible causal factors and to identify where future research may be warranted.

During the 12-year period from 2001 to 2012, a total of 1,903 motor vehicle accidents involving a pedestrian(s) were reported by provincial policing agencies, 510 of those occurring in rural New Brunswick. This equates to 26.4% or approximately 1 in 4 pedestrian-vehicle collisions occurring in rural areas. The resulting frequencies can be expressed as an overall provincial average rate of 158.6 pedestrian-vehicle collisions per year (42.5 pedestrian-vehicle collisions per year that occur in rural areas).

Table 1 – Number of pedestrian-vehicle collisions in rural New Brunswick per year

Year	Total Number of Collisions	Number of Rural Collisions
2001	193	55
2002	172	68
2003	175	51
2004	168	46
2005	149	45
2006	157	43
2007	152	38
2008	163	45
2009	146	23
2010	169	44
2011	152	31
2012	107	21
Total	**1903**	**510**
Annual Average	**158.6**	**42.5**

3.1 Severity of Collisions

Analyzing the severity of the vehicle-pedestrian collisions using the 12-year study period (2001-2012) showed that 339 or 66.5% of rural collisions resulted in injuries to the pedestrian and 64 or 12.5% of rural collisions resulted in a pedestrian fatality. In comparison, only 1,344 or 39.0% of urban collisions resulted in pedestrian injury and 64 or 1.9% of urban collisions resulted in a pedestrian fatality.

Table 2 – Number of pedestrian-vehicle collisions in rural New Brunswick by severity

Severity of Collision	Number of Collisions (2001-2012)	Percentage (%)
PDO	106	20.8
Injury	339	66.5
Fatality	64	12.5
Unknown	1	0.2

3.2 Pedestrian Characteristics

Pedestrians aged 20-29 were the most likely to be involved in a collision on a rural highway with 102 (20.0%) reported accidents. Pedestrians aged 40-49 and 60+ also had a high frequency of collisions with 94 (18.4%) and 91 (17.8%) reported accidents, respectively. Pedestrians under the age of 20 years were of particular concern given the increased likelihood for walking to access school. Interestingly, the youngest age groups were the least likely to be involved in a collision, accounting for only 7.3% of all rural collisions (<20 years).

Table 3 – Number of pedestrian-vehicle collisions in rural New Brunswick by age

Age	Number of Collisions	Percentage (%)
0-5	1	0.2
6-9	2	0.4
10-14	2	0.4
15-19	32	6.3
20-29	102	20.0
30-39	77	15.1
40-49	94	18.4
50-59	59	11.6
60+	91	17.8
Unknown	50	9.8

Male pedestrians were more often involved in vehicle-pedestrian collisions, accounting for 327 accidents or 64.1% of all rural collision (Table 4). Female pedestrians were involved in 134 collision or 26.3% of all rural collision, with the remaining pedestrian victims being unidentified.

Table 4 – Number of pedestrian-vehicle collisions in rural New Brunswick by gender

Gender	Number of Collisions	Percentage (%)
Male	327	64.1
Female	134	26.3
Unknown	49	9.6

The responding police officer determined the pedestrian action for each collision. The officer made the determination based on interviews with all persons involved and witnesses. For the 510 rural collisions, “on sidewalk/shoulder/boulevard” had the highest frequency, accounting for 68 or 13.3% of collisions (Table 5). Pedestrians “walking on roadway with traffic” had the second highest frequency, accounting for 66 or 12.9% of collisions.

Table 5 – Number of pedestrians involved in pedestrian-vehicle collisions in rural New Brunswick by pedestrian action

Pedestrian Action	Number of Collision	Percentage (%)
At Intersection, Crossing With Signal	7	1.4
At Intersection, Crossing Against Signal	1	0.2
At Intersection, Crossing, Marked X-Walk, No Signal	19	3.7
At Intersection, Crossing, No X-Walk, No Signal	27	5.3
Mid Block/Highway Crossing, Marked X-Walk	14	2.7
Mid Block/Highway Crossing, No X-walk	41	8.0
Walking on Roadway with Traffic	66	12.9
Walking on Roadway Against Traffic	57	11.2
Emerging From in Front or Behind Park Vehicle/Object	25	4.9
Running onto Roadway	57	11.2
Getting on/off School Bus	19	3.7
Getting on/off Vehicle	21	4.1
On Sidewalk/Shoulder/Boulevard	68	13.3
Pushing/Working on Vehicle	24	4.7
Playing on Roadway	13	2.5
Lying on Roadway	10	2.0
Hitch Hiking	4	0.8
Working On Roadway	9	1.8
Other/Unknown	28	5.5

3.3 Pedestrian Collisions by Time of Day and Season

The time of year affected the likelihood of a pedestrian being hit by a vehicle (Table 6). Over the 12 years, the months of December and January had the highest frequency of collisions with 60 and 61 accidents reported, respectively. Collision rates dropped significantly in late spring and early summer; April, May and June had the lowest frequency of collisions with 29, 28 and 26, respectively. These findings may be somewhat counter-intuitive but are likely related to decreased conspicuity during dark winter months or related to narrowed shoulders resulting from snow storage.

Table 6 – Number of pedestrian-vehicle collisions in rural New Brunswick by month

Month	Number of Collisions	Percentage (%)
January	61	12.0
February	34	6.7
March	44	8.6
April	29	5.7
May	28	5.5
June	26	5.1
July	47	9.2
August	40	7.8
September	42	8.2
October	54	10.6
November	45	8.8
December	60	11.8

The time of day also influenced the likelihood of a pedestrian-vehicle collision. The data in Table 7 showed that pedestrians being struck by a vehicle during the daylight, account for 293 or 57.4% of all reported rural accidents. This is to be expected given that the bulk of pedestrian activity is during the day. The remaining collisions that occur in the dark or under partial illumination likely represent an over-representation given lower pedestrian activity.

Table 7 – Number of pedestrian-vehicle collisions in rural New Brunswick by light condition

Light Condition	Number of Collisions	Percentage (%)
Daylight	293	57.5
Dark	187	36.7
Dusk	11	2.2
Dawn	11	2.2
Artificial Light	8	1.6

3.4 Collision Characteristics

The responding police officer determined the major contributing factor for each collision. The officer determined the contributing factor based on interviews with all persons involved and witnesses. For the 510 accidents reported, pedestrian error had the highest frequency, accounting for 131 or 25.7% of collisions (Table 8). Driver inattention had the second highest frequency, accounting for 99 or 19.4% of collisions. Note that only the primary major contributing factor was used in this study as it was determined the results may be skewed as not all collisions had the same number of major contributing factors.

The posted speed limit of the local road influenced the frequency and severity of collisions. The results from this study show that roads with a posted speed limit of 50km/hr and 80km/hr saw the highest number of collisions with 180 and 141 (35.3% and 27.6%) , respectively (Table 9). Roads with a posted speed limit of 90km/hr and higher, or 40 km/hr and lower, saw the lowest number of collisions. It is interesting to note that even in rural areas, many pedestrian-vehicle collisions have occurred at a low speed (39% of collision occurred at $\leq$ 50km/hr). The number of collisions observed may be influence by the frequency of of each speed limit. For example, if a speed limit of 50km/hr occurs more frequently, there would be a tendency to observe more collisions.

Table 8 – Number of pedestrian-vehicle collisions in rural New Brunswick by major contribution factor

Major Contribution Factor	Number of Collisions	Percentage (%)
Driver Inattention	99	19.4
Driver Distraction	14	2.7
Had Been Drinking	4	0.8
Driving While Impaired	10	2.0
Driver Inexperience/Confusion	9	1.8
Prescription Medication	1	0.2
Illness	1	0.2
Failure to Yield Right-of-Way	5	1.0
Traffic Control Device Disregard	5	1.0
Following Too Closely	14	2.7
Driving Too Fast for Road Condition	10	2.0
Exceeding Speed Limit	2	0.4
Passing or Lane Usage Improper	1	0.2
Backing Unsafely	6	1.2
Pedestrian Error	131	25.7
Taking Avoiding Action	1	0.2
Crossed Centre Line	1	0.2
Defective Brakes	1	0.2
Vision Obstruction/Obscured	14	2.7
Suspension/Wheel Failure	2	0.4
Defective Tow Hitch/ Connection	1	0.2
Animal Action (Deer)	1	0.2
Animal Action (Moose)	2	0.4
Surface Slippery	12	2.4
Snow Drift	6	1.2
Obstruction/Debris	2	0.4
View Obstructed/Limited	17	3.3
Glare	11	2.2
Uninvolved Vehicle	5	1.0
Uninvolved Pedestrian	45	8.8
Presence of Prior Accident	6	1.2
Other/Unknown	71	13.9

Table 9 – Number of pedestrian-vehicle collisions in rural New Brunswick by speed limit

Speed Limit (km/hr)	Number of Collisions	Percentage (%)
30 or less	6	1.2
40	13	2.5
50	180	35.3
60	51	10.0
70	45	8.8
80	141	27.6
90	22	4.3
100	13	2.5
110	28	5.5
Unknown	11	2.2

3.5 Collisions Resulting in Pedestrian Fatality

The data in Table 10 indicate that from 2001-2012, 64 (12.5%) pedestrian-vehicle collisions in rural areas resulted in a pedestrian fatality. In comparison, over the same period, the exact same number (64) collisions resulted in pedestrian fatality in *urban* regions of the province. As depicted in Table 10, the highest frequency of pedestrian fatalities in rural New Brunswick occurred in 2003 and 2005 with 9 fatalities each. The lowest frequency of pedestrian fatalities occurred in 2007 and 2008, with 2 fatalities each. On average, approximately 5 pedestrians/year are killed in vehicle-pedestrian collisions.

Table 10 – Number of pedestrians killed in pedestrian-vehicle collisions New Brunswick by year

Year	Number of Pedestrians Killed in Rural NB	Total Number of Pedestrians Killed in NB
2001	6	8
2002	7	13
2003	9	13
2004	5	11
2005	9	13
2006	7	16
2007	2	12
2008	2	7
2009	3	7
2010	6	12
2011	4	8
2012	4	8
Total	**64**	**128**

3.6 Pedestrian Characteristics in Fatalities

Male pedestrians involved in pedestrian-vehicle collisions were at a higher risk to be killed. Male pedestrians are over-represented in fatal collisions accounting for 51 (79.7%), while they were only in 64.1% of pedestrian collisions of all severities (Table 4 above). Female pedestrians accounted for only 6 (9.4%) of fatalities versus 26.3% for all severities of pedestrian collisions.

Table 11 – Number of pedestrians killed in pedestrian-vehicle collisions in rural New Brunswick by gender

Gender	Number of Pedestrians Killed	Percentage (%)
Male	51	79.7
Female	6	9.4
Unidentified	7	10.9

Pedestrians 20-29 years old were most likely to be fatally injured in rural highway collisions, accounting for 14 fatalities over the 12-year study period (Table 12). Pedestrians age 40-49 and 60+ also had high frequencies of deaths with 11 and 16 fatalities, respectively. Pedestrians under the age of 20 years were the least likely to be killed in a collision, accounting for only 3.1% of all rural pedestrian fatalities. There was no major difference between age groups in comparing Table 3 and Table 12.

Table 12 – Number of pedestrians killed in pedestrian-vehicle collisions in rural New Brunswick by age

Age	Number of Pedestrians Killed	Percentage (%)
0-5	1	1.6
6-9	1	1.6
10-14	0	0.0
15-19	0	0.0
20-29	14	21.9
30-39	9	14.1
40-49	11	17.2
50-59	5	7.8
60+	16	25.0
Unknown	7	10.9

As shown in Table 13 the 64 fatalities reported, “walking on the roadway with traffic” had the highest frequency, accounting for 15 or 23.4% of fatalities. Pedestrians “crossing mid block with no cross walk” and pedestrians “lying in the road” had the second highest frequencies, accounting for 8 or 12.5% of fatalities each. In comparison, pedestrians “walking on the roadway with traffic”, “crossing mid block with no cross walk” and “lying in the road” only accounted for 11.2%, 8.0% and 2.0%, respectively, for all pedestrian-vehicle collisions.

Table 13 – Number of pedestrians killed in pedestrian-vehicle collisions in rural New Brunswick by pedestrian action

Pedestrian Action	Number of Deaths	Percentage (%)
At Intersection, Crossing, Marked X-Walk, No Signal	1	1.6
Mid Block/Highway Crossing, No X-Walk	8	12.5
Walking on Roadway with Traffic	15	23.4
Walking on Roadway Against Traffic	6	9.4
Emerging From in Front or Behind Park Vehicle/Object	4	6.3
Running onto Roadway	7	10.9
Getting on/off School Bus	1	1.6
Getting on/off Vehicle	2	3.1
On Sidewalk/Shoulder/Boulevard	6	9.4
Pushing/Working on Vehicle	3	4.7
Playing on Roadway	2	3.1
Lying on Roadway	8	12.5
Unknown	1	1.6

3.7 Pedestrian Collisions by Time of Day and Season

Time of day also influenced the likelihood of a pedestrian fatality. Pedestrians were more likely to be fatally struck by a vehicle during darkness, accounting for 43 or 67.2% (Table 14) of all reported rural fatalities, which is significantly higher than the total number of pedestrian-vehicle collisions (Table 7) reported to occur in darkness.

Table 14 – Number of pedestrians killed in pedestrian-vehicle collisions in rural New Brunswick by light condition

Light Condition	Number of Pedestrians Killed	Percentage (%)
Daylight	18	28.1
Dark	43	67.2
Dusk	1	1.6
Dawn	1	1.6
Artificial light	1	1.6

The time of year can affect the likelihood of a pedestrian being fatally struck by a vehicle as shown in Table 15. Over the 12-year study, the months of December and September had the highest frequency of collisions resulting in fatality with 10 and 9 fatalities, respectively. Fatalities rates dropped significantly in late winter and Spring. January and February had 3 and 0 fatalities, respectively, while May and June had 3 and 2 fatalities, respectively. In comparing these results with Table 6, there were a high frequency (18.6%) of pedestrian-vehicle collisions resulting in PDO or injuries in January, February and March, while only 7 fatalities (10.9% of all fatalities) occurred in the same months.

Table 15 – Number of pedestrians killed in pedestrian-vehicle collisions in rural New Brunswick by month

Month	Number of Pedestrians Killed	Percentage (%)
January	3	4.7
February	0	0.0
March	4	6.3
April	7	10.9
May	3	4.7
June	2	3.1
July	7	10.9
August	7	10.9
September	9	14.1
October	5	7.8
November	7	10.9
December	10	15.6

3.8 Collision Characteristics of Fatalities

The posted speed limit of the local road influenced the frequency of fatalities. The results of the study, as presented in Table 16, show that roads with a posted speed limit of 70 km/hr and 80 km/hr saw the highest number of fatalities with 10 and 24, respectively. Roads with a posted speed limit of 90 km/hr and higher had the lowest number of fatalities. The higher frequency of fatalities in lower speed zones may be attributed to a higher concentration of pedestrians, since lower speeds are most likely located in and around small rural communities.

Table 16 – Number of pedestrians killed in pedestrian-vehicle collisions in rural New Brunswick by speed

	Pedestrian Collision Severity		
Speed	**Fatality**	**Personal Injury**	**PDO**
50 and less	10	126	54
60	9	27	14
70	10	30	4
80	24	98	20
90	5	15	2
100	3	4	6
110	3	20	5
Unknown	0	9	1

Weather was another factor to affect collision frequency and severity as seen in Table 17. In collisions that resulted in a pedestrian fatality, 35 or 54.7% occurred in ideal conditions, while very few fatalities occurred during inclement weather.

Table 17 – Number of pedestrians killed in collisions in rural New Brunswick by weather

Weather	**Number of Pedestrians Killed**	**Percentage (%)**
Clear	35	54.7
Cloudy	16	25.0
Raining	6	9.4
Snowing	5	7.8
Freezing Rain	0	0.0
Fog	2	3.1
Drifting Snow	0	0.0
Strong Wind	0	0.0

For the 64 accidents reported resulting in a pedestrian fatality, pedestrian error had the highest frequency, accounting for 28 or 43.8% of collisions (Table 18). Other contributing factors include driver inattention accounting for 9 or 14.1% of collision and glare, accounting for 4 or 6.3% of collisions. When comparing Table 8 and Table 18, the largest differences was in the "pedestrian error" major contributing factor. "Pedestrian error" accounted for 43.8% for all pedestrian-vehicle collisions resulting in fatality while it only accounted for 25.5% of all pedestrian-vehicle collisions.

Table 18 – Number of pedestrians killed in collisions in rural New Brunswick by major contributing factor

Major Contributing Factor	Number of Deaths	Percentage (%)
Driver Inattention	9	14.1
Had Been Drinking	3	4.7
Driving While Impaired	3	4.7
Driver Inexperience/Confusion	1	1.6
Illness	1	1.6
Failure to Yield Right-of-Way	1	1.6
Pedestrian Error/Confusion	28	43.8
Defective Brakes	1	1.6
Vision Obstructed/Obscured	2	3.1
Obstruction/Debris	1	1.6
View Obstructed/Limited	3	4.7
Glare	4	6.3
Unknown	7	10.9

3.9 School Zones

Over the 12-year study, it was determined that only 5 pedestrian-vehicle collisions, as shown in Table 19, may have happened in or near a school zone involving school aged (5-18 years old) children. However, due to insufficient location information, it is inconclusive whether these accidents occurred in a school zone.

Eighty (80) percent of accidents resulted in a high school-aged teen (1 male age 16, and 3 females age 17) being hit by a vehicle. The remaining collision involved a 5-year-old male child. Only 1 collision resulted in death (5-year-old male), which occurred at 7:55am; 3 collisions resulted in injuries (16-year-old male, and two 17-year-old females); while the last collision resulted in Property Damage Only.

Table 19 – Pedestrians killed in school zone collisions in rural New Brunswick

	Year	Time	Gender	Age	Speed Limit (km/hr)	Severity	Major Contributing Factor
1	2004	755	M	5	50	3	Driver Inattention
2	2001	1215	M	16	50	2	Pedestrian Error*
3	2002	1615	F	17	80	2	Glare
4	2001	1200	F	17	0	2	Driver Inattention
5	2005	1155	F	17	50	1	Not Applicable

*The pedestrian attempted to run across the road without looking in both directions for on coming traffic.

Chapter 4: Discussion

The results of the report provide a general review and basic analysis of New Brunswick's pedestrian-vehicle collision data. It explored the overall factors influencing rural based pedestrian-vehicle collisions and pedestrian fatalities, and attempted to explore school zone collisions. This chapter summarizes major findings, recommendations, future research topics, and limitations of the research.

4.1 Lighting Conditions

Lighting conditions were influential on the number of pedestrian-vehicle collisions and their severity. The findings of the research showed that a higher number of collisions happened during daylight hours. A possible reasoning for a higher frequency of collisions during daylight hours may be attributed to an increase in pedestrian and vehicle traffic during this time of day, in particular during the morning, lunch and evening rush hours. The higher number of collisions, however, does not correlate with more accidents; it is the opposite. The results showed that more severe pedestrian collisions occurred during darkness. This may be attributed to a number of factors such as reduced visibility due to lack of natural light, driving and/or walking under the influence of alcohol or drugs, or the lack of reflective clothing being worn by a pedestrian.

4.2 Pedestrian Age

The age of pedestrians being struck by a vehicle varied by each year. Although the age category of 20-29 had the most hits with 102, the age categories of 40-49 and 60+ had significantly high collision frequencies with 94 and 91, respectively. The results were

similar to those of the NB Pedestrian Senior Report (2005). The NB Pedestrian Senior Report found that 20.7% of pedestrians that were struck by a vehicle were in the 16-25 age category, while this report found that the 20-29 age category had a similar percentage of hits at 20.0%. One significant difference in results between the studies were the number of pedestrians 16 years old or younger involved in a collision. In the NB Pedestrian Senior Report, the result showed that 24.2% of pedestrians involved in a collision were under the age of 16 years old. In comparison, this study found only 8 children 16 years old or younger, or 3% of all pedestrians, were involved in collisions. The difference may be due to the greater likelihood that in rural areas, students are bused or driven to school by a parent versus students in urban areas. A study by Sjolie and Thuen (2002) supports this theory. Their study showed that 94% of the students surveyed who live in a rural area were regularly bused or driven to school while none of the urban students reported using the bus or cars to get to school.

4.3 Pedestrian Fatalities Overview

Over the 12-year study, 64 pedestrians were fatally injured in rural areas from vehicle collisions. On average, there were 5.3 fatalities/year or 7.1 fatalities/year•million people. In comparison, New Brunswick had much fewer fatalities on rural roads than found in the study by Hall *et al.* (2004) where they found that 37.72 pedestrian fatalities/year•million people were occurring in rural United States. This number is likely inflated due to the impact of large urban centers with significantly higher pedestrian activity.

4.4 Pedestrian Actions and Fatalities

Following the review of pedestrian actions in collisions involving a fatality, it was interesting to note that the highest numbers of fatalities were attributed with “walking on roadway with traffic”, with 15 fatalities or 20.0% of the collisions. The fatalities may be attributed to poor maintenance of gravel or paved shoulders, or installation of “walking strips”. With only one side of the road useable, these factors may have encouraged pedestrians to walk with their back to on coming traffic, which is very dangerous and against the motor vehicle act. The pedestrian action with the second highest frequency of fatalities was “lying on roadway” with 8 fatalities or 10.7%. These fatalities are possibly attributed to alcohol or drug use given the age cohort of most of those involved.

The major contributing factors for pedestrian-vehicle collisions resulting in fatality indicate that 37.3% were caused by pedestrian error. In comparison, only 25.7% of all pedestrian-vehicle collisions were attributed to pedestrian error. The variance may be due to improper reporting by the police. According to the data, 65 collisions were reported as unknown or not applicable for the major contributing factor. It also may be due to the higher percentage of collisions (19.4%) being caused by driver inattention. A driver, who was not paying attention at the time, may have been able to swerve or slow down just in time to prevent a fatal collision with a pedestrian.

4.5 School Zones

A review of school zone pedestrian-vehicle collisions was carried out. Unfortunately, due to insufficient location information, the research was unable to conclude that the 5

collisions identified actually occurred in school zones. Regardless of locations, the data provided some insight of collisions involving school aged children during school hours. It was interesting to note that 80% of the collisions reported occurred during noon-hour and involved high school aged students. The high concentration of collisions occurring at noon hour may be attributed to the majority of rural students being bused or driven to and from school, while at noon hour, some provincial high schools allow students off school grounds. In comparison, elementary and middle school have a "closed campus" policy, which does not permit students to leave the grounds during school hours, including noon hour, unless signed out by a parent or guardian.

4.6 Recommendations

4.6.1 Education

There is a large amount of educational information available to the public that discusses safety strategies for all road users. Educational information, such as pamphlets, are an inexpensive and easy tool to use in an effort to reduce the number of pedestrian-vehicle collisions. In New Brunswick, published educational information is minimal. The "Driver Handbook", a publication for teens and adults learning to drive, contains a half page of safety tips for using provincial highways. The province should update this manual as it lacks important safety information for drivers, such as the advantages of reducing speeds especially at night time and during the winter months, and to be more vigilant on roads with no separation between pedestrians and vehicles. For pedestrians, the information should stress the importance of walking against traffic and the danger of playing on and around rural highways.

4.6.2 Accident Report/Accident Report Database Update

The current New Brunswick accident report is completed by hand by the responding police officer. Completing the form by hand may lead to the inability to read certain information, making it difficult for the data entry staff at NBDTI. Since all police vehicles are now equipped with laptops, it is recommended that these report be completed digitally to reduce human error. Switching to a digital reporting system would have other benefits for the provincial government. It would provide a more up to date database with real time information. Having the most recent data will enable engineers to better monitor the effects of road improvements or the installation of safety devices on pedestrian safety.

The provincial government should make updates to the motor vehicle accident report. The reports should include a check box indicating if the collision occurred in a school zone. Currently, researchers have to make assumptions in order to attempt to identify collisions occurring in a school zone. In most cases, due to the lack of accurate information, this method is non conclusive on determining school zone collisions. The report should also collect GPS coordinates. Having a more accurate location identification would help isolate problem areas that require further investigation and/or corrective action.

4.7 Future Research

The research has identified three main areas of rural New Brunswick pedestrian safety that should be studied further.

1) Additional research should study the collision sites in detail. This research may identify problem areas that require immediate corrective action or further investigation. The research should include a review of "walking strips" and their effects on pedestrian collisions.
2) Research on the relationship between pedestrians walking under the influence of drugs and/or alcohol should be carried out. There are indications from this research that some fatalities may be attributed to drugs and/or alcohol; however, there is insufficient data to draw any conclusions.
3) Further research should be carried out on school zone pedestrian-vehicle collisions as the findings from the report were inconclusive. Future research may require personal interviews with those hit by a vehicle to determine accident locations.

4.8 Limitations of the Research

4.8.1 Database

The database maintained by the province does not store all information that is on the motor vehicle accident report. The missing information includes sketches or diagrams of the collisions and any handwritten notes from the police officer. Instead, this information is stored separately, either on microfiche or scanned to a hard drive, making it difficult to obtain. The database also does not contain GPS coordinates for each collision resulting in the inability to investigate site characteristics such as shoulder width, pavement markings and sight lines.

4.8.2 Human Error

There are two main sources of human error in the collection of data by the Province. The first source is the police officer, who is required to complete the motor vehicle accident report by hand. This may result in a hard to read reports attributed to poor penmanship. The second source of error is entering the information manually into the database. The person entering the information may hit an incorrect key or misread the information on the motor vehicle accident report causing the data to be inaccurate.

4.8.3 Reporting of All Collision

Not all minor accidents get reported to police. If an accident occurs, resulting in very little or no damage to any property or if there are no injuries to report, the police may not be notified of the accident or they may not respond. If an officer does not show up to the accident, then no report is produced. The lack of data for these collisions can skew the results of research, and may cause the percentages of injuries or fatalities to be inflated when compared to the total number of pedestrian-vehicle collisions.

4.9 Concluding Statement

The research has identified that rural pedestrians are at a higher risk to be injured of killed than urban pedestrians in a vehicle-pedestrian collision. This highlights the greater need for a focus on vulnerable road users in rural areas. Greater focus should be placed on the collection and analysis of collision data. This information should be kept up to date and reviewed frequently to ensure safety initiatives are performing as intended. Provincial governments should also develop new design policies to ensure all new road

construction and reconstruction includes safety features and devices to allow all users to travel safely.

References

Anderson, G., Searfoss, L., Cox, A., Schilling, E., Seskin, S., & Zimmerman, C. (2015). Safer streets, stronger economies: complete streets project outcomes from across the United States. *ITE Journal, June*(85), 6th ser., 29-36.

Arason, N. (2014). *No accident: Eliminating injury and death on Canadian roads*. Waterloo, ON: Wilfred Laurier University Press.

Astrid, S., & Thuen, F. (2002). School journeys and leisure activities in rural and urban adolescents in Norway. *Health Promotion International, 17*(1), 21-28.

Bostock, L. (2001). Pathways of disadvantage? Walking as a mode of transport among low-income mothers. *Health Soc Care Community Health and Social Care in the Community, 9*(1), 11-18.

Canada, Transport Canada. (2009). *Improving travel options in small & rural communities* (pp. 1-36).

Canada, Transport Canada. (2015). *Canadian motor vehicle traffic collision statistics 2013*.

Cicchino, J. (2016). Effectiveness of Volvo's City Safety Low-Speed Autonomous Emergency Braking System in Reducing Police-Reported Crash RatesJes. *Insurance Institute for Highway Safety*.

City Safety reduces low speed accidents on Volvo's XC60 and S60. (2013, June). Retrieved March 2, 2016, from http://www.itsinternational.com/sections/nafta/features/city-safety-reduces-low-speed-accidents-on-volvos-xc60-and-s60/

Dumbaugh, E., & Li, W. (2010). Designing for the safety of pedestrians, cyclists, and motorists in urban environments. *Journal of the American Planning Association, 77*(1), 69-88.

Fitzpatrick, K., & Park, E. (2009). Safety Effectiveness of HAWK Pedestrian Treatment. *Transportation Research Record: Journal of the Transportation Research Board, 2140,* 214-223.

Godley, S. T., Triggs, T. J., & Fildes, B. N. (2004). Perceptual lane width, wide perceptual road centre markings and driving speeds. *Ergonomics, 47*(3), 237-256.

Hall, J. W., Brogan, J. D., & Kondreddi, M. (2004). *Pedestrian safety on rural highways* (pp. 1-21, Tech. No. FHWA-SA-04-008).

Hildebrand, E.D., D.D. Mason, D.P. Paradis, and K.E. Hazzard, *Long-Term Effectiveness of Radar Speed Display Boards in School Zones*, Proceedings of the Canadian Multidisciplinary Road Safety Conference XXIV , Vancouver, BC, June 2014.

Karger, B., Teige, K., Bühren, W., & Duchesne, A. (2000). Relationship between impact velocity and injuries in fatal pedestrian-car collisions. *Int J Leg Med International Journal of Legal Medicine, 113*(2), 84-88.

Litman, T. (2004). Whose roads? Defining bicyclists' and pedestrians' right to use public roadways. *Victoria Transport Policy Institute,* 1-14.

Makowsky, M. D., & Stratmann, T. (2011). More tickets, fewer accidents: How cash-strapped towns make for safer roads. *The Journal of Law and Economics, 54*(4), 863-888.

Malloy, G. (2012, June 1). Volvo's pedestrian airbag raises the bar. Retrieved March 6, 2016, from http://www.wheels.ca/news/volvos-pedestrian-airbag-raises-bar-4/

McCants, P. (2015, October 25). 2016 Civic takes pedestrian impact safety to new levels. Retrieved March 6, 2016, from http://www.torquenews.com/1574/2016-civic-takes-pedestrian-impact-safety-new-levels

Melanson, A. (2005). *Analysis of Vehicle/Pedestrian Collisions Within New Brunswick* (Unpublished senior report). University of New Brunswick.

Province of New Brunswick, Department of Public Safety. (2011). *New Brunswick driver's handbook: A guide to learning safe driving skills*.

Rothman, L., Macpherson, A., Buliung, R., Macarthur, C., To, T., Larsen, K., & Howard, A. (2015). Installation of speed humps and pedestrian-motor vehicle collisions in Toronto, Canada: A quasi-experimental study. *BMC Public Health, 15*(1).

Rothman, L., Slater, M., Meaney, C., & Howard, A. (2010). Motor Vehicle and Pedestrian Collisions: Burden of Severe Injury on Major Versus Neighborhood Roads. *Traffic Injury Prevention, 11*(1), 43-47.

Richard, R., Ferguson, S., & McCartt, A. (2004). *A review of evidence-based traffic engineering measures to reduce pedestrian-motor vehicle crashes* (Rep.).

Statistics Canada. (2011). *Population, urban and rural, by province and territory (New Brunswick).* Retrieved March 1, 2016 from Statistics Canada: http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo62e-eng.htm

Toroyan, T., Khayesi, M., & Peden, M. (2013). Time to prioritise safe walking. *International Journal of Injury Control and Safety Promotion, 20*(2), 197-202.

Zegeer, C. V., & Bushell, M. (2012). Pedestrian crash trends and potential countermeasures from around the world. *Accident Analysis & Prevention, 44*(1), 3-11.

Appendix A

New Brunswick Report of Motor Vehicle Accident

New Nouveau Brunswick

REPORT OF MOTOR VEHICLE ACCIDENT

PLEASE PRESS FIRMLY - YOU ARE MAKING (3) COPIES

DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE

1 LIGHT CONDITION
01. Daylight
02. Dark
03. Dusk
04. Dawn
05. Artificial Light

2 WEATHER CONDITION
01. Clear
02. Cloudy
03. Raining
04. Snowing
05. Sleet / Hail / Freezing Rain
06. Fog / Smoke / Smog
07. Drifting Snow / Dust
08. Strong Wind

3 4 ROAD SURFACE TYPE
V1 / V2
01. Asphalt
02. Gravel
03. Dirt / Earth
04. Concrete
05. Chip Seal

5 6 ROAD SURFACE CONDITION
V1 / V2
01. Dry
02. Snow
03. Ice
04. Wet
05. Muddy
06. Loose Gravel or Sand
07. Slush
08. Fresh Oil

7 8 UNUSUAL ROAD CONDITION
V1 / V2
01. Under Construction
02. Under Repair
03. Holes, Ruts, Bumps
04. Changing Road Width
05. Flooded

9 10 ROADWAY ALIGNMENT
V1 / V2
01. Level and Straight
02. Level and Curve
03. Straight with Grade
04. Curve with Grade
05. Top of Hill
06. Bottom of Hill

11 12 ROADWAY CHARACTER
V1 / V2
01. Undivided - 1 Way
02. Undivided - 2 Way, 2 Lane
03. Undivided - 2 Way, Multi-Lane
04. Divided - Barrier
05. Divided - Median - No Barrier

13 14 TRAFFIC CONTROL
V1 / V2
01. No Control Present
02. Traffic Signal
03. Flashing Traffic Signal
04. Stop Sign
05. Yield Sign
06. Marked Pedestrian Crossing
07. Reduced Speed Zone
08. Flagman / Police Officer
09. RR Crossing - No Control
10. RR Crossing - Signs, Crossbuck
11. RR Crossing - Signal
12. RR Crossing - Gates
13. RR Crossing - Watchman
14. No Passing Zone
15. School Bus Exhibiting Flashing Red Light

15 16 TRAFFIC CONTROL CONDITION
V1 / V2
01. Functioning
02. Not Functioning
03. Missing
04. Vandalized

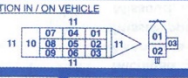
GENERAL CODES
97. Not Applicable
98. Unknown
99. Other, Specify in Comments

17 18 SPECIAL FACILITY
V1 / V2
01. Interchange - Through Lane
02. Traffic Circle
03. Entrance Ramp
04. Exit Ramp
05. Overpass - Bridge
06. Underpass, Tunnel, Subway
07. Climbing Lane
08. Parking Lot
09. Dock / Wharf
10. Ferry

19 20 VEHICLE IDENTIFICATION
V1 / V2
01. Passenger Car
21. Multi Purpose Veh / Passenger Van
02. Pickup Trucks under 4500 Kg
03. Panel / Cargo Van under 4500 Kg
04. Trucks 4500 Kg and over
05. Truck Tractor (Bobtail)
55. Truck Tractor with Towed Unit
06. Motorcycle
07. Motor Driven Cycle
08. Bicycle
09. Transit Bus
10. Inter-City Bus
11. School Bus
12. Other Bus
13. Ambulance / Police / Fire
14. Motorhome
15. Motorized Snow Vehicle
16. Construction and Maintenance - Equip.
17. Farm Equipment
18. Off Highway Vehicle

21 22 TOWED UNIT
V1 / V2
01. Tent Trailer
02. Travel Trailer
03. Boat Trailer
04. Utility Trailer
05. Farm Equipment
06. Towed Motor Vehicle
07. Low / High Bed (Semi)
08. Single Trailer (Semi)
09. Double Trailer (Semi)
10. Petroleum or Other Tanker (Semi)
11. Over-Dimensioned Vehicle No Pilot Vehicle
12. Over-Dimensioned Vehicle with Pilot Vehicle

POSITION IN / ON VEHICLE
01. Driver
02-10. Passenger
11. Riding or Hanging On
12. Pedestrian



EJECTION FROM VEHICLE
01. Not Ejected
02. Ejected
03. Partially Ejected

INJURY CODE
02. Minor - No Treatment
03. Moderate - Treated and Released
04. Major - Hospitalized
05. Fatal - At Scene or DOA
06. Fatal - Within 48 Hours
07. Fatal - Within 30 Days

SAFETY EQUIPMENT USED
01. Lap & Shoulder Belt
02. Lap Belt
03. Seatbelts and Air Bag Deployed
04. Air Bag Deployed
05. Passive Seatbelts
06. Child Restraint
07. Helmets
08. Protective Clothing
09. None Available
10. Available Not Used

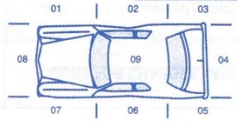
Which Vehicle Occupied 23 | Position In / On Vehicle 24 | 25 | 26 | AGE 27 | M-Male F-Female 28 | 29 | NAME & ADDRESS 30

PRE-COLLISION VEHICLE ACTION
01. Going Straight Ahead
02. Turning Right
03. Turning Left
04. Making U-Turn
05. Starting From Parked Position
06. Entering Parked Position
07. Starting in Traffic
08. Slowing or Stopping
09. Stopped in Traffic
10. Parked Legally
11. Parked Illegally
12. Changing Lanes
13. Overtaking
14. Merging
15. Backing
V1 → 31 | V2 → 32

MAJOR CONTRIBUTING FACTORS
01. Driver Inattention
02. Driver Distraction
03. Had Been Drinking
04. Driving While Impaired
05. Extreme Fatigue
06. Fell Asleep
07. Driver Inexperience / Confusion
08. Lost Conciousness
09. Physical Disability
10. Prescription Medication
11. Drugs (Illegal)
12. Illness
13. Excessive Hours of Service
14. Use of Electronic Device
21. Failure to Yield Right-of-Way
22. Traffic Control Device Disregarded
23. Following Too Closely
24. Driving Too Fast for Road Conditions
25. Exceeding Speed Limit
26. Turning Improper
27. Passing or Lane Usage Improper
28. Backing Unsafely
29. Pedestrian Error / Confusion
30. Failed to Signal
31. Wrong Way
32. Taking Avoiding Action
33. Crossed Centre Line
40. Defective Brakes
42. Vision Obstruction / Obscured
43. Defective Steering
44. Suspension / Wheel Failure
45. Defective Tires
46. Defective Tow Hitch / Connection
47. Engine / Power Train
48. Hood / Door Opening
49. Vehicle Color / Dirty / Snow Covered
50. Jacknife / Trailer Swing
51. Vehicle Modifications
52. Exhaust
53. Load Shift
54. Over Dimensioned Vehicle
55. Electrical
56. Defective Headlights
57. Defective Rearlights
60. Animal Action (Deer)
61. Animal Action (Moose)
62. Animal Action (Other)
63. Surface Slippery
64. Loose Gravel
65. Snow Drift
66. Obstruction / Debris
67. View Obstructed / Limited
68. Glare
69. Construction Zone
70. Defective Driving Surface
71. Shoulders Defective / Inadequate
72. Lane Markings Inadequate
73. Traffic Control Device Not Working
74. Crosswind
75. Hydroplaning
76. Uninvolved Vehicle
77. Uninvolved Pedestrian
78. Presence of Prior Accident
V1 → 33, 34, 35, 36 | V2 → 37, 38, 39, 40

SEQUENCE OF EVENTS
01. Another Vehicle
02. Animal
03. Pedestrian
04. Bicyclist
05. Farm Machinery
06. Maintenance Machinery
07. Construction Machinery
08. Railroad Train
09. Other Movable Object
10. Debris
20. Ditch Bottom / Back Slope
21. Approach
22. Traffic Barricade
23. Sign Post
24. Traffic Signal Standard
25. Street Light Standard
26. Telephone / Power Pole
27. Guide Rail
28. Bridge Structure
29. Tree / Bush
30. Parking Meter
31. Building / Wall
32. Curbing
33. Fence
34. Culvert
35. Snow Embankment / Drift
36. Rock Cut
37. Delineator Posts
38. Fire Hydrant
39. Median / Barrier
40. Crash Cushion
41. Gravel Pile
42. Mail Box
43. Low Hanging Wires
49. Other Fixed Object
50. Ran Off Road
51. Overturned
52. Fire / Explosion
53. Submersion
54. Skidding / Sliding
55. Load Spilled
V1 → 1ST EVENT 41 | 2ND EVENT 42 | 3RD EVENT 43
V2 → 1ST EVENT 44 | 2ND EVENT 45 | 3RD EVENT 46

LOCATION OF IMPACT



10. Undercarriage
11. Interior
12. More Than Three Areas
13. Towed Unit

V1 → PRIMARY IMPACT 47 | OTHER DAMAGE 48 | OTHER DAMAGE 49
V2 → PRIMARY IMPACT 50 | OTHER DAMAGE 51 | OTHER DAMAGE 52

PEDESTRIAN ACTION
01. At Intersection, Crossing With Signal
02. At Intersection, Crossing Against Signal
03. At Intersection, Crossing, Marked X-Walk, No Signal
04. At Intersection, Crossing, No X-Walk, No Signal
05. Mid Block / Highway Crossing Marked X-Walk
06. Mid Block / Highway Crossing No X-Walk
07. Walking on Roadway with Traffic
08. Walking on Roadway Against Traffic
09. Emerging From in Front or Behind Parked Vehicle / Object
10. Running onto Roadway
11. Getting On / Off School Bus
12. Getting On / Off Vehicle Other Than School Bus
13. On Sidewalk / Shoulder / Boulevard (Not on Roadway)
14. Pushing / Working On Vehicle
15. Playing on Roadway
16. Lying on Roadway
17. Hitch Hiking
18. Working on Roadway
→ 53

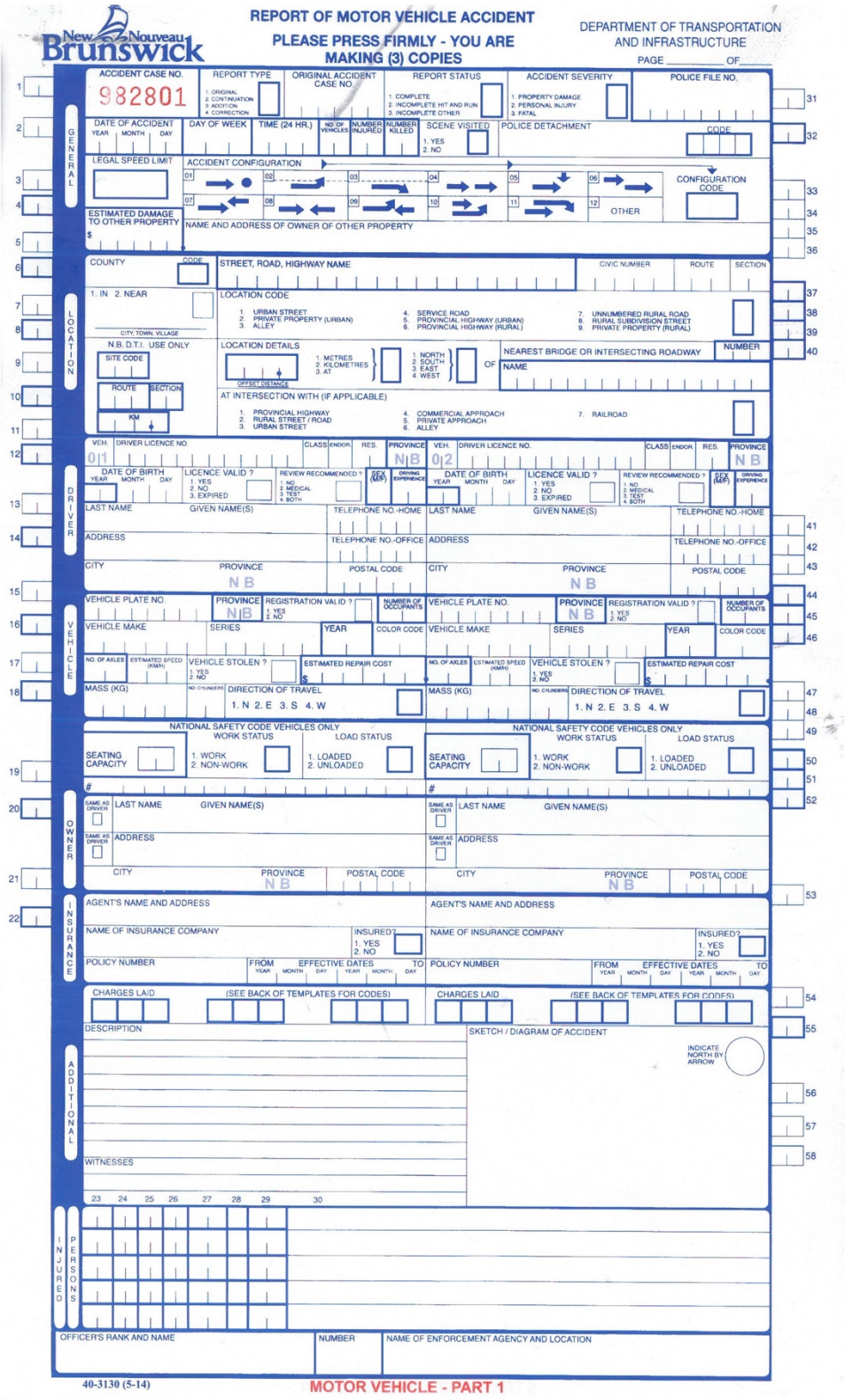
DANGEROUS GOODS
01. Explosives
02. Gases
03. Flammable Liquids
04. Flammable Solids
05. Oxidizing Substances
06. Poisonous and Infectious Substances
07. Radioactive Materials
08. Corrosive Substances
09. Miscellaneous Dangerous Substances or Articles
V1 → 54 | V2 → 55

SPECIAL STUDIES
→ 56, 57, 58

INJURED PERSONS

OFFICER'S RANK AND NAME	NUMBER	NAME OF ENFORCEMENT AGENCY AND LOCATION

40-3130 (5-14)



New Nouveau Brunswick

REPORT OF MOTOR VEHICLE ACCIDENT

PLEASE PRESS FIRMLY - YOU ARE MAKING (3) COPIES

DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE

PAGE _____ OF _____

GENERAL

ACCIDENT CASE NO.: 982801

REPORT TYPE: 1. ORIGINAL 2. CONTINUATION 3. ADDITION 4. CORRECTION

ORIGINAL ACCIDENT CASE NO.

REPORT STATUS: 1. COMPLETE 2. INCOMPLETE HIT AND RUN 3. INCOMPLETE OTHER

ACCIDENT SEVERITY: 1. PROPERTY DAMAGE 2. PERSONAL INJURY 3. FATAL

POLICE FILE NO.

DATE OF ACCIDENT: YEAR MONTH DAY

DAY OF WEEK

TIME (24 HR.)

NO. OF VEHICLES

NUMBER INJURED

NUMBER KILLED

SCENE VISITED: 1. YES 2. NO

POLICE DETACHMENT CODE

LEGAL SPEED LIMIT

ACCIDENT CONFIGURATION: 01 02 03 04 05 06 07 08 09 10 11 12 OTHER

CONFIGURATION CODE

ESTIMATED DAMAGE TO OTHER PROPERTY: $

NAME AND ADDRESS OF OWNER OF OTHER PROPERTY

LOCATION

COUNTY CODE

STREET, ROAD, HIGHWAY NAME

CIVIC NUMBER | ROUTE | SECTION

1. IN 2. NEAR

CITY, TOWN, VILLAGE

LOCATION CODE: 1. URBAN STREET 2. PRIVATE PROPERTY (URBAN) 3. ALLEY 4. SERVICE ROAD 5. PROVINCIAL HIGHWAY (URBAN) 6. PROVINCIAL HIGHWAY (RURAL) 7. UNNUMBERED RURAL ROAD 8. RURAL SUBDIVISION STREET 9. PRIVATE PROPERTY (RURAL)

N.B. D.T.I. USE ONLY: SITE CODE | ROUTE | SECTION | KM

LOCATION DETAILS: OFFSET DISTANCE 1. METRES 2. KILOMETRES 3. AT 1. NORTH 2. SOUTH 3. EAST 4. WEST OF

NEAREST BRIDGE OR INTERSECTING ROADWAY NAME | NUMBER

AT INTERSECTION WITH (IF APPLICABLE): 1. PROVINCIAL HIGHWAY 2. RURAL STREET / ROAD 3. URBAN STREET 4. COMMERCIAL APPROACH 5. PRIVATE APPROACH 6. ALLEY 7. RAILROAD

DRIVER

	VEH. 01	VEH. 02
DRIVER LICENCE NO.		
CLASS / ENDOR. / RES.		
PROVINCE	NB	NB
DATE OF BIRTH (YEAR MONTH DAY)		
LICENCE VALID ? 1. YES 2. NO 3. EXPIRED		
REVIEW RECOMMENDED ? 1. NO 2. MEDICAL 3. TEST 4. BOTH		
SEX (M/F)		
DRIVING EXPERIENCE		
LAST NAME		
GIVEN NAME(S)		
TELEPHONE NO.-HOME		
ADDRESS		
TELEPHONE NO.-OFFICE		
CITY		
PROVINCE	NB	NB
POSTAL CODE		

VEHICLE

VEHICLE PLATE NO.		
PROVINCE	NB	NB
REGISTRATION VALID ? 1. YES 2. NO		
NUMBER OF OCCUPANTS		
VEHICLE MAKE		
SERIES		
YEAR		
COLOR CODE		
NO. OF AXLES		
ESTIMATED SPEED (KM/H)		
VEHICLE STOLEN ? 1. YES 2. NO		
ESTIMATED REPAIR COST $		
MASS (KG)		
NO. CYLINDERS		
DIRECTION OF TRAVEL 1. N 2. E 3. S 4. W		

NATIONAL SAFETY CODE VEHICLES ONLY: SEATING CAPACITY | WORK STATUS 1. WORK 2. NON-WORK | LOAD STATUS 1. LOADED 2. UNLOADED

OWNER

#		
SAME AS DRIVER		
LAST NAME		
GIVEN NAME(S)		
SAME AS DRIVER		
ADDRESS		
CITY		
PROVINCE	NB	NB
POSTAL CODE		

INSURANCE

AGENT'S NAME AND ADDRESS		
NAME OF INSURANCE COMPANY		
INSURED? 1. YES 2. NO		
POLICY NUMBER		
EFFECTIVE DATES FROM (YEAR MONTH DAY) TO (YEAR MONTH DAY)		

CHARGES LAID (SEE BACK OF TEMPLATES FOR CODES)

ADDITIONAL

DESCRIPTION

SKETCH / DIAGRAM OF ACCIDENT

INDICATE NORTH BY ARROW

WITNESSES

INJURED PERSONS

23 24 25 26 27 28 29 30

OFFICER'S RANK AND NAME | NUMBER | NAME OF ENFORCEMENT AGENCY AND LOCATION

40-3130 (5-14)

MOTOR VEHICLE - PART 1

Appendix B

List of Municipalities in

New Brunswick

Cities	
Bathurst	11
Campbellton	08
Dieppe	15
Edmundston	12
Fredericton	01
Miramichi	05
Moncton	09
Saint John	04

Towns	
Beresford	108
Bouctouche	112
Caraquet	31
Dalhousie	14
Florencville-Bristol	183
Grand Bay/Westfield	55
Grand Falls	16
Hampton	131
Hartland	17
Lameque	65
Nackawic	56
Oromocto	03
Quispamsis	63
Richibucto	153
Riverview	58
Rothesay	51
Sackville	21
Saint-Leonard	25
Saint-Quentin	167
Shediac	22
Shippigan	52
St Andrews	23
St George	24
St Stephen	26
Sussex	28
Tracadie-Sheila	53
Woodstock	02

Albert	06
Carleton	11
Charlotte	02
Gloucester	15
Kent	08
Kings	05
Madawaska	13
Northumberland	09
Queens	04
Restigouche	14
Saint John	01
Sunbury	03
Victoria	12
Westmorland	07
York	10

Villages	
Alma	100
Aroostook	101
Atholville	102
Baker Brook	103
Balmoral	104
Bas-Caraquet	105
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Blacks Harbour	54
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Harvey	132
Hillsborough	133
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Pointe-Verte	150
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Salisbury	168
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Stanley	171
Sussex Corner	172
Tide Head	173
Tracy	174

Curriculum Vitae

Candidate's full name:	Scott William Adams
University Attended:	University of New Brunswick Bachelor of Science in Civil Engineering, BScE 2004-2008